APPENDIX 2-G

WILD HORSE RIDGE TANK SEAM

SOIL RESOURCE INVENTORY AND ASSESSMENT

SOIL RESOURCE INVENTORY AND ASSESSMENT

BEAR CANYON MINE
WILD HORSE RIDGE TANK SEAM PORTAL
EMERY COUNTY, UTAH

For:
C.W. Mining Company
P.O. Box 1245
Huntington, Utah 84528

By:
EIS Environmental & Engineering Consulting
31 North Main Street
Helper, Utah 84526

December 2001

SOIL INVENTORY AND ASSESSMENT
BEAR CANYON MINE
WILD HORSE RIDGE TANK SEAM PORTAL

Table of Contents

SOIL INVENTORY AND ASSESSMENT
BEAR CANYON MINE
WILD HORSE RIDGE TANK SEAM PORTAL

1.0 Introduction

This Soils report covers an area consisting of a portal site and road segment for the proposed Wild Horse Ridge Tank Seam Portal at the Bear Canyon Mine. It is an extension to the area covered in a soils report prepared in May 1999 by Environmental Industrial Services (EIS) for the Bear Canyon Mine, Wild Horse Ridge Portal. It is located about eight miles northwest of Huntington in Emery County, Utah (SW ¼, SE ¼, Section 24, T. 16 S., R. 7 E.). Access would be along an existing single lane road that would need some upgrading. The existing road bisects the proposed portal site and continues through the project area to a hunting cabin. The segment of access road for this project is about ¼ mile in length and the portal site is about 2.5 acres.

The project is on a steep northwest facing canyon slope at an elevation of 7,680 to 7,950 feet. The vegetation includes pinyon pine, curlleaf mountain mahogany, Douglas fir, juniper, serviceberry, sagebrush, and grasses. The geologic materials include sandstone, shale and minor amounts of coal from the Blackhawk Formation. The average annual precipitation is estimated at about 16 inches, and average annual air temperature is 38 to 45 degrees F.

2.0 Methods and Procedures

The soil inventory was conducted by Daniel M. Larsen, Soil Scientist, EIS. Project details and the base map were provided by Charles Reynolds, Mining Engineer, C.W. Mining Company; Katie Nash and Barbara Jensen, EIS, assisted with the final report and soils map preparation. Soil testing was conducted by Inter-Mountain Laboratories, Inc., Farmington, New Mexico. Fieldwork was done on October 23, 2001 according to National Soil Survey guidelines and mining project requirements identified by the State of Utah, Division of Oil, Gas and Mining.

Road cuts were used extensively for gathering soils information along the access road as well as at the portal site. Notes were recorded for 21 points and two full soil profile descriptions were recorded on NRCS form 232. Data obtained from the existing road cuts were supplemented by walking over the undisturbed portal site area and making shallow excavations with a tile spade. Deep digging with a spade was limited by the high stone content of the soil at the portal site.

Representative soil samples were collected at the portal site in one-gallon size plastic freezer bags. Five samples were selected for analysis of parameters recommended by the Utah Division of Oil, Gas and Mining. These samples were as follows:

P1	0-8 inches	Soil description site number TSP-1. A-horizon (Guben soil series).
P2	9-20 inches	Soil description site number TSP-1. BK1 horizon.
P3	24-40 inches	Soil description site number TSP-1. BK 2 horizon.
P4	0-7 inches	Composite of A horizon soil from the portal site.
P5	10-20 inches	Soil description number TSP-2. BW horizon (Datino soil series).

See Appendix D, photographs TS-4 and TS-5 for visual information on these sample sites. Field soil profile descriptions and field notes are given in Appendix D.

3.0 Results and Discussion

3.1 Soil Mapping and Soil Descriptions

A soils map was prepared showing various soil map units, soil description locations and note points (Section 5, Soils Map). The units mapped were similar to units in the soils report for Bear Canyon Mine, Wild Horse Ridge Portal in May 1999.

At the portal site the soils are formed from colluvial materials derived from sandstone and shale. Slopes are about 45 percent and the surface is stony to bouldery. Soils have been mapped as the Datino-Guben (DG) soil map unit. These soils are similar with the main difference being that the Guben soil is more calcareous than the Datino soil. Both have a calcium carbonate accumulation in the subsoil, but the Datino soil is not calcareous at the surface.

These soils typically have a dark brown to very dark brown (moist) surface layer with a sandy loam to loam texture. Thickness of the A-horizon is seven to ten inches with an average of about eight inches. The Datino soils have a brown sandy loam layer up to about ten inches in thickness below the A-horizon. Underlying these soil layers is a zone of calcium carbonate accumulation. This soil layer is very cobbly to very stony and has a lighter color than the surface layers. The calcic horizon ranges from about two to three feet in thickness and overlies very stony calcareous colluvium.

The soils at the portal site are classified as loamy-skeletal, mixed, Typic Calciborolls (Guben) and loamy-skeletal, mixed Typic Haploborolls (Datino). Typical soil series descriptions for these soils as identified in Carbon County by the Natural Resources Conservation Services are given in Appendix E.

Along the access road the soils are quite variable. They range form deep cobbly soils formed in colluvium to shallow soils over shale and sandstone bedrock. Topsoils are generally six to ten inches thick and have loam to sandy loam textures. Notable along the access road is a portion that is underlain by shale varying in color from reddish-brown to dark gray. These soils are shallow to moderately deep and often have some cobbly colluvial material at the surface. This soil area was mapped as the Doney-Cabba-Pado (DCP) soil map unit. Topsoils are commonly four to six inches thick but range up to nine inches. Subsoils are clay loam to silty clay.

A small portion of the access road is in the Guben-Pathead (GP) soil map unit. It consists of deep, very cobbly to very stony soils and shallow to moderately deep stony soils over sandstone bedrock. Topsoils range from about four to eight inches in thickness.

All of the soils at the portal site and along the access road are well drained.

3.2 Soil Laboratory Testing Results and Suitability Rating

Data from soil testing conducted by Inter-Mountain Laboratories, Inc. are shown in Appendix B. These data were compared to values of selected parameters to evaluate the soil suitability as a plant growth material as recommended by the Utah Division of Oil, Gas and Mining (DOGM). Criteria used are from table 2 in "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining" by DOGM, 1988. This table is shown in Appendix A.

A summary of the test values and rating is given below:

Parameter	Test Values	Rating
PH	7.1 to 7.7	Good
	8.5 for P3	Fair
Electrical Conductivity	0.46 to 0.85 mmhos/cc	Good
Saturation Percent	27 to 49%	Good
Texture	Sandy Loam to Loam	Good
SAR	0.1 to 0.2	Good
Selenium	Less than 0.02	Good
Boron	0.3 to 1.3 mg./kg.	Good
Acid/Base Potential	7.0 to 386.5 t/kt	Good
Available Water Capacity	0.12 to 0.16 in/in (est.)	Good

Rock fragments were estimated in the field and ranged from about 20 to 30 percent for surface soils and 40 to 60 percent for subsoils. This would yield a fair to poor rating, but is a natural feature of soils in the area.

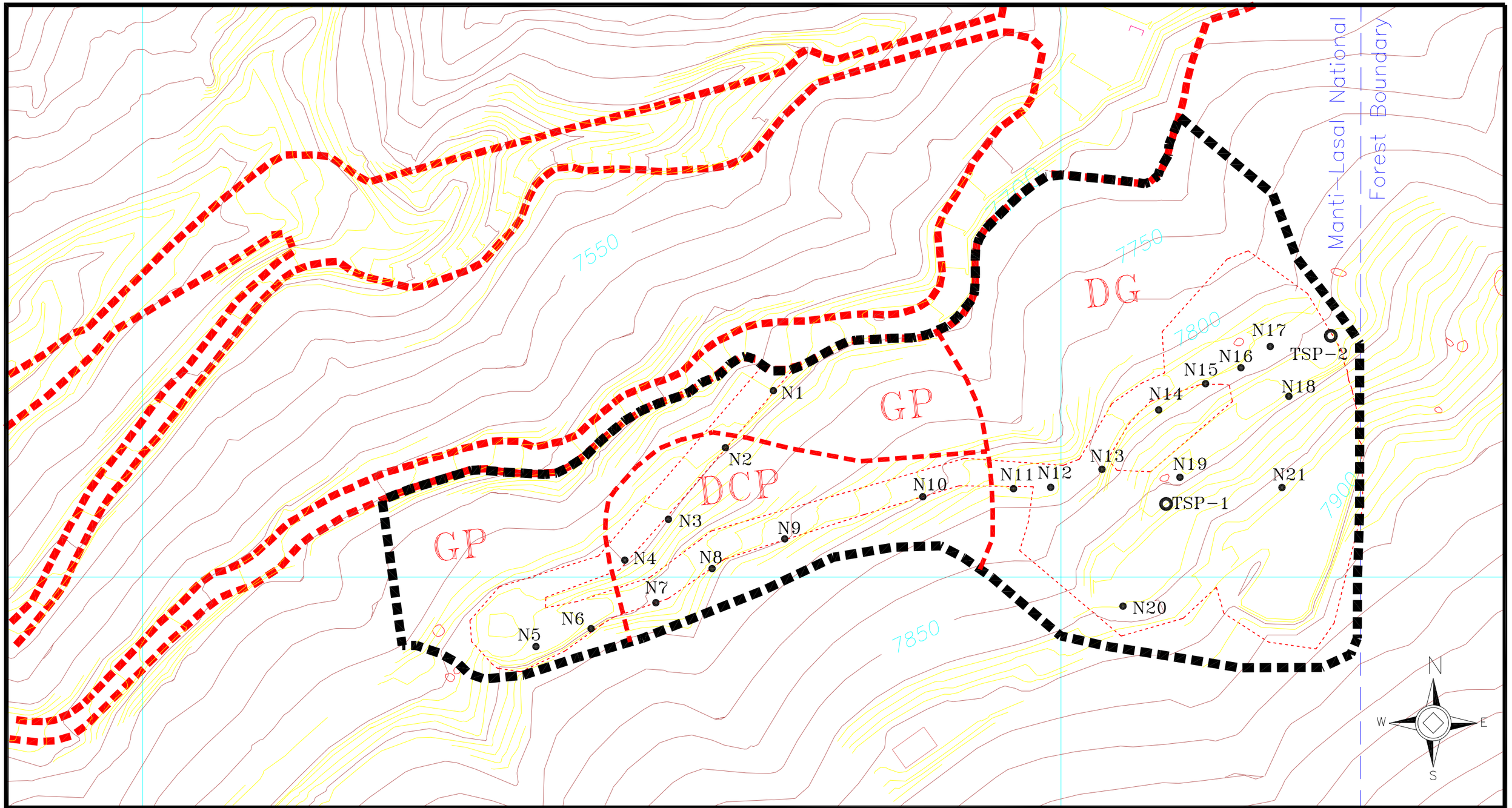
Subsoils are high in calcium carbonate (up to 40 percent) and would rate as fair to poor. Surface soils ranged from 0.8 to 11.5 percent calcium carbonate, which would be good.

Overall the topsoils rate good for plant growth based on laboratory analysis and would be fair when considering the rock fragment content (especially stones and boulders). Subsoils would be fair to poor based on rock fragments and carbonates.

Organic matter, nitrogen, phosphorus, and potassium are all substantially higher in the upper eight inches of topsoil compared to the subsoils.

3.3 Soil Salvage

At the Tank Seam Portal site the topsoil layer averages about eight inches. This is good A-horizon material that should be salvaged. There are pockets of a brown sandy loam BW horizon that extends to about 20 inches. This was only noted along the northeast edge of the portal site. The material is lighter colored than the topsoil but darker than the high carbonate subsoils below. It could be salvaged and mixed with the A-horizon. The subsoils, which are high in carbonates and rock fragment content, would be suitable for plant growth but should not be considered as salvageable topsoil. The subsoil can be readily identified by its lighter color as a result of the increased calcium carbonate content and lower amount of organic matter.



LEGEND

- DISTURBED AREA / SOIL BOUNDRY
- SECTION LINE
- 7350 CONTOUR LINE
- SURVEY BOUNDARY
- PROPOSED DISTRUBED AREA
- TSP-1 SOIL DESCRIPTION AND SAMPLING SITES
- N1 TRANSECT NOTE SITES
- DG DATINO-GUBEN
- GP GUBEN-PATHEAD
- DCP DONEY-CABBA-PODO

E.I.S. is not responsible for errors or omissions. Reference data was provided by C. W. Mining Company.

Acad Ref: COOP MINE, SOILMAPBASE

Date:	Dec. 6, 2001
Drawn by:	BJensen
Approved by:	Dan Larsen
Scale:	1" = 100'

CLIENT:

C. W. MINING COMPANY
BEAR CANYON MINE
WHR TANK SEAM PORTAL

MAP TITLE: SOILS MAP

Environmental Industrial Services
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SOIL INVENTORY AND ASSESSMENT
BEAR CANYON MINE
WILD HORSE RIDGE TANK SEAM PORTAL

4.0 APPENDICES

A. Soil Stability Criteria
B. Soil Laboratory Testing Results
C. Soil and Landscape Photographs
D. Field Soil Profile Descriptions and Transect Notes

Appendix A

Bear Canyon Mine
Wild Horse Ridge Tank Seam Portal

Soil Suitability Criteria

Reference: Leatherman, James and Dan Duce, 1988. Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining, State of Utah Department of Natural Resources, Division of Oil, Gas and Mining. Salt Lake City, Utah.

Soil Suitability Criteria

UDOGM: Overburden Evaluation for Vegetative Root Zone; Table 2 (Leatherwood and Duce 1988)

Parameters	Good	Fair	Poor	Unacceptable
pH	6.1 - 8.2	5.1 - 6.1 8.2 - 8.4	4.5 - 5.0 8.5 - 9.0	less than 4.5 greater than 9.0
Ec mmhos/cm 25°C	0 - 2	2 - 8	8 -15	greater than 15
Saturation %	25% - 80%		less than 25% greater than 80%	
Texture	sl, l, sil, scl, vfsl, fsl	cl, sicl, sc, ls, lfs	sic, s, sc, c, cos, fs, vfs	g, vcos
SAR	0 - 4	5 - 10	10 - 12 Fine Texture 10 - 15 Coarse Texture	12 Fine Texture 15 Coarse Texture
Selenium	less than 0.1 mg/Kg			greater than 0.1 mg/Kg
Boron	less than 5.0 mg/Kg			greater than 5.0 mg/Kg
Acid/Base Potential	greater than -5 tons $CaCO_3$ 1,000 tons material			less than -5 tons $CaCO_3$ 1,000 tons material
% Coal fines	Undetermined at this time			
Available water capacity (in/in)	greater than 0.10	0.05 - 0.10	less than 0.05	
Rock Fragments (% volumes) 3 inches 3 - 10 inches 10 inches	 0 - 15 0 - 15 0 - 3	 15 - 25 15 - 25 3 - 7	 25 - 30 25 - 30 7 - 10	 greater than 30 greater than 30 greater than 10

Appendix B

Bear Canyon Mine
Wild Horse Ridge Tank Seam Portal

Soil Laboratory Testing Results

Soil Sample Identification
Bear Canyon Mine
Wild Horse Ridge Tank Seam Portal

P1	0-8 inches	Soil description site number TSP-1. A horizon (Guben soil series).
P2	9-20 inches	Soil description site number TSP-1. BK1 horizon.
P3	24-40 inches	Soil description site number TSP-1. BK 2 horizon.
P4	0-7 inches	Composite of A horizon soil from the portal site.
P5	10-20 inches	Soil description number TSP-2. BW horizon (Datino soil series).

Soil Sample Colors (Munsell)

Sample I.D.	Dry Color	Moist Color
P1 0-8 inches	10 YR 4/3 (Brown)	10 YR 3/2 (Dark Brown)
P2 9-20 inches	10 YR 5/3 to 6/3 (Brown to Pale Brown)	10 YR 4/3 to 5/3 (Brown)
P3 24-40 inches	10 YR 6/3 (Pale Brown)	10 YR 5/3 (Brown)
P4 0-7 inches	7.5 YR 4/3 to 10 YR 4/3 (Brown)	7.5 YR 2.5/2 (Very Dark Brown)
P5 10-20 inches	7.5 YR 5/4 to 5 YR 5/4 (Brown to Reddish Brown)	7.5 YR 4/4 (Brown)

iml

Inter-Mountain Laboratories, Inc.

Phone (505) 326-4737 Fax (505) 325-4182

2506 West Main Street, Farmington, NM 87401

November 14, 2001

Daniel M. Larsen
Environmental Industrial Services
31 North Main Street
Helper, UT 84526

Dear Mr. Larsen:

Attached are the analytical results for the samples received by IML on October 29, 2001. The samples were labeled C.W. Mining Co. – Portal Site and correspond to IML lab numbers 0301S04726-4730. The requested analysis were pH, EC, sat %, SAR, texture incl. very fine sand, calcium carbonate %, acid-base potential, alkalinity, organic matter, total organic carbon, AB-DTPA extractable selenium, boron, phosphorous, potassium, nitrate – N, and total Kjeldahl nitrogen.

If you have any questions or comments please call (800) 828-1409. Thank you for choosing Inter-Mountain Labs.

Sincerely,

Jeff Goats
Soil Scientist
IML – Farmington

Enclosure: Analytical Report

iml
Phone (505) 326-4737 Fax (505) 325-4182

Inter-Mountain Laboratories, Inc.
2506 West Main Street, Farmington, NM 87401

C.W. Mining Co.
Huntington, UT

Client Project ID: Bear Canyon Mine - Tank Seam Portal
Date Received: 10/29/01

IML Project #0301S04726
Report Date: 11/14/01

Lab Id	Sample Id	Depths Inches	pH s.u.	Electrical Conductivity mmhos/cm	Saturation %	Ca meq/L	Mg meq/L	Na meq/L	SAR ratio	Sand %	Silt %	Clay %	Texture USDA	Sand, Very Fine %
0301S04726	P1 TSP-1	(0 - 8)	7.5	0.68	49	6.5	1.5	0.20	0.1	61	21	18	SL	12
0301S04727	P2 TSP-1	(9 - 20)	7.8	0.46	42	5.3	0.90	0.22	0.1	51	29	20	L	8
0301S04728	P3 TSP-1	(24 - 40)	8.5	0.55	27	1.9	4.8	0.43	0.2	59	27	14	SL	11
0301S04729	P4 Composite	(0 - 7)	7.1	0.85	39	6.3	2.3	0.29	0.1	69	19	12	SL	10
0301S04730	P5 TSP-2	(10 - 20)	7.7	0.46	29	3.8	1.4	0.32	0.2	69	17	14	SL	10

jml

Inter-Mountain Laboratories, Inc.

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2506 West Main Street, Farmington, NM 87401

C.W. Mining Co.

Huntington, UT

Client Project ID: Bear Canyon Mine - Tank Seam Brial

IML Project #0301S04726

Date Received: 10/29/01

Report Date: 11/14/01

Lab Id	Sample Id		Depths Inches	Total Sulfur %	Neutral. Potential t/kt	Acid Base Total S t/kt	ABP Total S t/kt	Alkalinity meq/L	Calcium Carbonate %	TOC %	Organic Matter %	Nitrate - N mg/Kg	Phosphorous mg/Kg	Potassium mg/Kg	Total Kjeldah Nitrogen %
0301S04726	P1	TSP-1	(0 - 8)	0.02	116.4	0.6	115.8	6.8	11.5	1.5	2.6	5.0	3.0	170	0.14
0301S04727	P2	TSP-1	(9 - 20)	0.02	387.1	0.6	386.5	6.0	40.6	1.0	1.7	1.9	1.3	28	0.09
0301S04728	P3	TSP-1	(24 - 40)	0.01	307.9	0.3	307.6	4.8	30.6	0.4	0.7	1.9	<0.1	26	0.03
0301S04729	P4	Composite	(0 - 7)	0.02	9.3	0.6	8.7	2.6	0.8	1.3	2.2	1.0	3.2	310	0.10
0301S04730	P5	TSP-2	(10 - 20)	0.01	7.3	0.3	7.0	3.6	0.8	0.3	0.5	2.9	0.8	69	0.03

iml

Inter-Mountain Laboratories, Inc.

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2506 West Main Street, Farmington, NM 87401

C.W. Mining Co.

Huntington, UT

Client Project ID: Bear Canyon Mine - Tank Seam Portal

Date Received: 10/29/01

IML Project #0301S04726

Report Date: 11/14/01

Lab Id	Sample Id		Depths Inches	Boron Soluble mg/Kg	Selenium AB - DTPA mg/Kg
0301S04726	P1	TSP-1	(0 - 8)	1.3	<0.02
0301S04727	P2	TSP-1	(9 - 20)	0.6	<0.02
0301S04728	P3	TSP-1	(24 - 40)	0.5	<0.02
0301S04729	P4	Composite	(0 - 7)	1.2	<0.02
0301S04730	P5	TSP-2	(10 - 20)	0.3	<0.02

Inter-Mountain Laboratories, Inc.
2506 West Main Street, Farmington, NM 87401

C.W. Mining Co.
Huntington, UT

Client Project ID: Bear Canyon Mine - Tank Seam Portal
Date Received: 10/29/01

IML Project #0301S04726
Report Date: 11/14/01

Lab Id	Sample Id (Tank Seam Portal Site)	Depths Inches	pH s.u.	Electrical Conductivity mmhos/cm	Saturation %	Ca meq/L	Mg meq/L	Na meq/L	SAR ratio	Sand %	Silt %	Clay %	Texture USDA	Sand, Very Fine %
0301S04726	P1 TSP-1	(0 - 8)	7.5 G	0.68 G	49 G	6.5	1.5	0.20	0.1 G	61	21	18	SL G	12
0301S04727	P2 TSP-1	(9 - 20)	7.8 G	0.46 G	42 G	5.3	0.90	0.22	0.1 G	51	29	20	L G	8
0301S04728	P3 TSP-1	(24 - 40)	8.5 F	0.55 G	27 G	1.9	4.8	0.43	0.2 G	59	27	14	SL G	11
0301S04729	P4 Composite	(0 - 7)	7.1 G	0.85 G	39 G	6.3	2.3	0.29	0.1 G	69	19	12	SL G	10
0301S04730	P5 TSP-2	(10 - 20)	7.7 G	0.46 G	29 G	3.8	1.4	0.32	0.2 G	69	17	14	SL G	10

With evaluation notes (DMG)

F - Fair
G - Good

Inter-Mountain Laboratories, Inc.
2506 West Main Sheet, Farmington, NM 87401

C.W. Mining Co.
Huntington, UT

Client Project ID: Bear Canyon Mine - Tank Seam Portal
Date Received: 10/29/01

IML Project #0301S04726
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Lab Id	Sample Id		Depths Inches	Total Sulfur %	Neutral Potential t/kt	Acid Base Total S t/kt	ABP Total S t/kt	Alkalinity meq/L	Calcium Carbonate %	TOC %	Organic Matter %	Nitrate - N mg/Kg	Phosphorous mg/Kg	Potassium mg/Kg	Total Kjeldah Nitrogen %
0301S04726	P1	TSP-1	(0 - 8)	0.02	116.4	0.6	115.8 G	6.8	11.5	1.5	2.6	5.0	3.0	170	0.14
0301S04727	P2	TSP-1	(9 - 20)	0.02	387.1	0.6	386.5 G	6.0	40.8 *	1.0	1.7	1.9	1.3	28	0.09
0301S04728	P3	TSP-1	(24 - 40)	0.01	307.9	0.3	307.6 G	4.8	30.6 *	0.4	0.7	1.9	<0.1	26	0.03
0301S04729	P4	Composite	(0 - 7)	0.02	9.3	0.6	8.7 G	2.6	0.8	1.3	2.2	1.0	3.2	310	0.10
0301S04730	P5	TSP-2	(10 - 20)	0.01	7.3	0.3	7.0 G	3.6	0.8	0.3	0.5	2.9	0.8	69	0.03

Topsoil

* Calcic horizon

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Huntington, UT

Client Project ID: Bear Canyon Mine - Tank Seam Portal
Date Received: 10/29/01

IML Project #0301S04726
Report Date: 11/14/01

Lab Id	Sample Id		Depths Inches	Boron Soluble mg/Kg	Selenium AB - DTPA mg/Kg
0301S04726	P1	TSP-1	(0 - 8)	1.3 G	<0.02 G
0301S04727	P2	TSP-1	(9 - 20)	0.6 G	<0.02 G
0301S04728	P3	TSP-1	(24 - 40)	0.5 G	<0.02 G
0301S04729	P4	Composite	(0 - 7)	1.2 G	<0.02 G
0301S04730	P5	TSP-2	(10 - 20)	0.3 G	<0.02 G

Appendix C

Bear Canyon Mine
Wild Horse Ridge Tank Seam Portal

Soil and Landscape Photographs

By, D. Larsen, EIS Environmental & Engineering Consulting
October 23, 2001

TS-1
At the proposed WHR Tank Seams Portal site showing the general vegetation, landform and deep colluvial soil materials.

TS-2
Soils at the WHR Tank Seam Portal site exposed by the road cut in the Guben-Datino soil unit. The spade is 44 inches long.

TS-3
The location of soil description TSP-1 at the WHR Tank Seam Portal site.

TS-4
Soil profile of the Guben soil recorded as description TSP-1. Soil samples P1 (0-8 inches), P2 (9-20 inches), and P3 (24-40 inches) were taken from this site.

TS-5

Site of soil description TSP-2 and soil sample P5 (10-20 inches) at the northeast edge of the portal site. The brown soil layer is not calcareous and the soil classifies as the Datino series.

TS-6

Sandstone bedrock exposed along the access road at Note Point N1. Soils are shallow to moderately deep over bedrock and consist of Podo and Pathead soils.

TS-7

Soils at Note Point N2. A thin layer of cobbly colluvium over shale. Topsoil varies from 4 to 8 inches in thickness.

TS-8

Soil exposed on a road cut along the access road at Note Point N3. This is in the DCP (Doney-Cabba-Pado) soil unit. The soils are shallow to moderately deep over shale and have thin topsoils.

TS-9
Soils at Note Point N7 on stratified shale and coal within the DCP soil unit along the access road.

TS-10
Soils on reddish colored shale in the DCP soil unit along the access road at Note Point N9.

TS-11

Road cut showing geologic materials and soils at Note Points N5 and N6 within the Guben-Pathead (GP) soil unit. At the far end of the road cut the soils are formed mostly on shale of the DCP (Doney-Cabba-Pado) soil unit.

TS-12

A Guben soil along the access road at Note Point N12.

Appendix D

Bear Canyon Mine
Wild Horse Ridge Tank Seam Portal

Field Soil Profile Descriptions and Transect Notes

SCS-SOILS-232G
REV. 12-70
FILE CODE SOILS-11

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

C.W. Mining Co. Proj.

SOIL DESCRIPTION

Soil type Guben — Tank Seam Portal — File No. TSP-1

Area Bear Canyon Mine - Upper Portal site (Wildhorse) — Date D. Larsen 10-23-01 — Stop No. 1

Classification Loamy-skeletal, mixed, Typic Calciborall

Location South 1/3 of portal site

N. veg. (or crop) Curlleaf mahagony, Douglas-Fir, Serviceberry, pinyon pine, grasses — Climate Frigid, Usric

Parent material Sandstone and shale - Colluvium

Physiography Mountain side / Canyon side

Relief Steep, single slope — Drainage Well drained — Salt or alkali —

Elevation 7850 feet — Gr. water — — Stoniness V. stony - Bouldery

Slope 45% — Moisture — Dry

Aspect NW 335° — Root distrib. No root restricting layers — % Clay* 17

Erosion Slight — % Coarse fragments* 50-60 — % Coarser than V.F.S.* 50-60%

Permeability Moderate — About 16% of sand is vfs

Additional notes

Boulder surface = 10% cover

Sampled: A 0-8" P1
BK1 9-20" P2
BK2 24-40" P3

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		5
Cobble 3-10"		5
Stone 10-24"		10
Boulder >24"		10
Vegetation		30
Litter		35
Bare		5

* Control section average

Horizon	Depth inches	Color Dry (Mixed)	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution	
A	Range 8-11 0-9	Brown 10YR 4/3	Dark Brown 10YR 3/2	18 c SL	WFGR	SO	FR	SS/SP	em 7.5	CW	10 G 15 C. 10 S.	MVF-F CM-Co	
BK1	9-24	Brown To Pale brown 10YR 5/3 - 6/3	Brown 10YR 4/3 - 5/3	20 c L	WFSBK	SH	SFI	SS/SP	es 7.8	GW	30 G. 20 C 10 S	CF	
BK2	24-40	Pale Brown 10YR 6/3	Brown 10YR 5/3	14 c SL	WFSBK-OM	SH	SFI	SS/SP	es 8.5	GW	"	FF	
C	40-60+	10YR 5/3 - 6/3	Brown 10YR 4/3	SL	OM	SH	SFI	SS/SP	es ~8.0		"		

SCS-SOILS-232G
REV. 12-70
FILE CODE SOILS-11

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

C. W. Mining Co. Proj.

Soil type Datino — Tank Seam Portal — File No. TSP-2

Area Bear Canyon Mine - Wildhorse upper portal site | Date 10-23-01 D. Larsen | Stop No. 2

Classification Loamy-skeletal, mixed, Typic Haploborall

Location North end of road cut, switch back at portal site

N. veg. (or crop) Douglas-fir, curlleaf mahogany, grasses | Climate Frigid, USFRC

Parent material Sandstone / colluvium

Physiography Mountain side / Canyon side

Relief V. steep | Drainage Well drained | Salt or alkali —

Elevation 7830' | Gr. water — | Stoniness Very stony / Bouldery

Slope 55% | Moisture | % Clay * 7 / 16

Aspect NW | Root distrib. Not restricted

Erosion — | % Coarse fragments * 50 | % Coarser than V.F.S. * 55-60 %

Permeability Mod. rapid

Additional notes

Sampled Bw @ 9-20" - PS

P4, A 0-7 part of a complex

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		5
Cobble 3-10"		5
Stone 10-24"		10
Boulder >24"		15
Vegetation		20
Litter		40
Bare		5

* Control section average

Horizon	Depth inches	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution	
A	0-7	Brown 7.5YR 4/5 - 10YR 4/3	Dk. Brown 7.5YR 2.5/2	SL	WFGR	SO	FR	SS SP	eo 7.2	cw	10 G 15 C 5 S	C VF-F F M	
Bw	7-23	Brown to reddish Br. 7.5YR 5/4 - 5YR 5/4	Brown 7.5YR 4/4	SL	WFSBK	SO	FR	SS SP	eo 7.7	cw	15 G 15 C 10 S	F VF-F	
Bk	23-50	Pale Br. 10YR 5/3 - 6/3	Brown 10YR 4/3 - 5/3	SL	WFSBK-OM	SH	SFI	SS SP	es	gw	15 G 15 C 10 S 10 B		
C	50-100+	10YR 5/3	10YR 4/3	SL	OM	SH	SFI	SS/SP	es		15 G 20 C 10 S 12 B		

Soil Inventory Field Notes 11/23/01 DMX.
Bear Canyon Mine
Wild Horse Ridge Tank Seam Portal
(See Soils Map for locations)

N1 - Reddish colored sandstone bedrock along access road. Shallow and moderately deep soils (Pado and Pathead). About 6 inches of topsoil.

N2 - Mixed shale and cobbly colluvium over clayey shale material. Topsoil ranges from 4 to 8 inches thick. 10YR 3/2 loam over clay loam.

N3 - Cobbly soil over shale at about 1 to 3 feet in depth. Topsoil is about 5 to 6 inches thick. Loam to silty clay loam textures.

N4 - About 8 inches of topsoil (A-horizon) over reddish colored shale and pockets of cobbly colluvium. Mostly a clay loam to silty clay loam texture.

N5 - Cobbly colluvium with boulders near the switchback in the access road. Some calcic horizon development

N6 – Rocky roadcut. Mixed cobbly colluvium, shale, and coal. Sandstone bedrock at about 4 to 8 feet. Calcic horizon is discontinuous; mostly in colluvium.

N7 – 6 to 8 inches of dark colored topsoil (A-horizon) over a grayish colored shale stratified with yellowish brown. Loam over silty clay loam.

N8 – About 4 inches of topsoil over alternate gray, brown, and reddish colored shale. Shallow to moderately deep. Clay loam and silty clay loam.

N9 – About 8 inches of A horizon over weathered reddish colored shale. 50% slope, Douglas-fir, Curlleaf mahogany. Silty clay loam

N10 – 10 inches of topsoil (A) over reddish shaly material.

N11 10 inches of loamy topsoil (A) over cobbly Bk horizon. Gibson soil

N12 - Loamy-skeletal Calciboroll, Guban soil.

N13 - Concentration of large boulders at a slight draw (weakly formed drainage).

N14 - Bouldery, loamy-skeletal Calciboroll 10 to 12" of dark colored A horizon over a Bk horizon (Calcic)

N15 - 12 inches of A horizon over a cobbly Bk. 1-sk, Calciboroll, Guban soil

N16 - Loamy-skeletal Calciboroll (Guban) About 20 inches to the Bk horizon

N17 - At switchback by portal site
8 inches of A-horizon (Topsoil)
Loamy-skeletal, Calciboroll (Guban)
Has a calcic horizon, cobbly colluvium

N18 - Road cut at portal site
Very deep stony colluvium
(Stones, cobble + boulders)
Carbonate layer at 10 to 2 feet
7-10 inches of A horizon
Spots of Bw (brown sandy loam) up to 10 inches
Thick That in non calcareous like Dutline soils

N19 - Description site for TSP-1
Deep cobbly colluvium
loamy-skeletal, Typic Calcixerroll
45% slope, Curlleaf mahogany, D-fir
8" of A horizon - Loamy

N20 - Stony and bouldery along slight draw
mostly Douglas-fir, at edge of
portal site - Too stony to dig
est. weaker Bk horizon

N21 General area of Topsoil Sample
identified as P4 (0-7") Ave. sandy
loam, Stony and bouldery surface
Slightly more sandy on northeast edge.
Weaker calcic horizon on SW corner.
Very difficult digging due to stones, Mostly
checked Topsoil and used roadcuts for deeper
information.
Site is quite uniform and materials
appear similar on the site. Some
spots are more calcareous. Walked over
the site up to the flagged edge.

Appendix E

Bear Canyon Mine
Wild Horse Ridge Tank Seam Portal

NRCS Soil Series and Family Descriptions

Reference: Jensen, Earl H. and James W. Borchert, 1988. Soil Survey on Carbon Area, Utah. USDA Soil Conservation Service.

Cabba Family

The Cabba family consists of shallow, well drained, moderately permeable soils on benches, canyon rims, and steep canyonsides. These soils formed in residuum and colluvium derived dominantly from shale or siltstone of the Green River Formation. Slope is 3 to 70 percent. Elevation is 5,000 to 8,200 feet. Average annual precipitation ranges from 12 to 16 inches, and average annual air temperature ranges from 42 to 45 degrees F.

These soils are loamy, mixed (calcareous), frigid, shallow Typic Ustorthents.

Reference pedon of a Cabba family bouldery loam in an area of Cabba family-Guben-Rock outcrop complex, on the slopes of Cottonwood Ridge, about 250 feet west and 1,500 feet north of the southeast corner of sec. 7, T. 13 S., R. 16 E.

A1—0 to 3 inches; pale brown (10YR 6/3) bouldery loam, brown (10YR 4/3) moist; moderate medium granular structure parting to moderate fine granular; loose, slightly sticky and slightly plastic; common very fine and fine roots; 5 percent pebbles, 10 percent cobbles, and 15 percent boulders; slightly calcareous; disseminated calcium carbonate; mildly alkaline (pH 7.8); abrupt smooth boundary.

C1—3 to 7 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine granular structure; loose, slightly sticky and slightly plastic; common very fine and fine roots; slightly calcareous; mildly alkaline (pH 7.8); abrupt smooth boundary.

C2—7 to 15 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; slightly calcareous; moderately alkaline (pH 8.3); abrupt smooth boundary.

C3r—15 inches; rippable shale; soft carbonate coatings on surface of rock.

Paralithic contact is at a depth of 8 to 20 inches.

A horizon: Hue is 10YR or 5Y, and value is 4 or 5 when moist. Texture is gravelly loam, bouldery loam, or extremely channery loam.

C horizon: Hue is 10YR or 2.5Y, value is 5 or 6 when dry, and chroma is 2 to 4. Texture is loam, gravelly loam, or clay loam. Clay content is 20 to 35 percent. Rock fragment content is 0 to 30 percent.

Datino Series

The Datino Series consists of very deep, well drained, moderately permeable soils on canyonsides and mountain slopes. These soils formed in colluvium derived dominantly from sandstone and shale. Slope is 15 to 80 percent. Elevation is 6,800 to 8,700 feet. Average annual precipitation ranges from 16 to 20 inches, and average annual air temperature ranges from 38 to 45 degrees F.

These soils are loamy-skeletal, mixed Typic Haploborolls.

Typical pedon of a Datino extremely stony fine sandy loam in an area of Perma family-Datino complex, about 0.25 mile south of Soldier Creek Mine, 2,400 feet west and 2,200 feet south of the northeast corner of sec. 18, T. 13 S., R. 12 E.

A1—0 to 10 inches; brown (10YR 4/3) extremely stony fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; few very fine pores; 15 percent pebbles, 25 percent cobbles, and 25 percent stones; moderately alkaline (pH 7.9); clear smooth boundary.

B2—10 to 16 inches; brown (10YR 5/3) very stony loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine and fine pores and few medium pores; 15 percent pebbles, 15 percent cobbles, and 10 percent stones; slightly calcareous; moderately alkaline (pH 7.9); gradual wavy boundary.

Clca—16 to 41 inches; pale brown (10YR 6/3) very stony fine sandy loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine and fine pores; 15 percent pebbles, 20 percent cobbles, and 25 percent stones; strongly calcareous; soft powdery masses of calcium carbonate; moderately alkaline (pH 8.0); gradual smooth boundary.

C2—41 to 60 inches; pale brown (10YR 6/3) very stony fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; few very fine pores; 15 percent pebbles, 20 percent cobbles, and 25 percent stones; moderately calcareous; disseminated calcium carbonate; moderately alkaline (pH 7.9).

Secondary calcium carbonate is at a depth of 15 to 22 inches. The mollic epipedon is 10 to 15 inches thick. The solum is 15 to 22 inches thick. The particle-size control section is 35 to 60 percent rock fragments.

A horizon: Value is 4 or 5 when dry and 2 or 3 when moist, and chroma is 2 or 3.

B2 horizon: Value is 3 to 5 when dry and 2 to 4 when moist, and chroma is 2 or 3. Clay content is 18 to 26 percent. Rock fragment content is 35 to 45 percent. Reaction is mildly alkaline or moderately alkaline.

C horizon: Value is 5 or 6 when dry, and chroma is 2 or 3. Clay content is 16 to 25 percent. Rock fragment content is 40 to 70 percent. Reaction is mildly alkaline or moderately alkaline.

Doney Family

The Doney family consists of moderately deep, well drained, moderately permeable soils on benches, foot slopes, and mountain slopes. These soils formed in residuum and colluvium derived dominantly from siltstone, shale, and sandstone. Slope is 3 to 70 percent. Elevation is 6,700 to 9,500 feet. Average annual precipitation ranges from 14 to 20 inches, and average annual air temperature ranges from 38 to 45 degrees F.

These soils are fine-loamy, mixed, frigid Typic Ustochrepts.

Reference pedon of a Doney family stony loam in an area of Rabbitex-Doney family-Midfork family complex, about 7.5 miles northwest of Helper, 800 feet south and 1,800 feet east of the northwest corner of sec. 19, T. 12 S., R. 9 E.

A1—0 to 4 inches; brown (10YR 5/3) stony loam, dark brown (10YR 3/3) moist; weak medium platy structure parting to moderate medium granular; soft, friable; common very fine and fine roots; few very fine pores; 10 percent pebbles, 5 percent cobbles, and 5 percent stones; slightly calcareous; disseminated calcium carbonate; moderately alkaline (pH 8.4); abrupt smooth boundary.

B21—4 to 11 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and common fine roots; few very fine pores; 5 percent pebbles and 5 percent cobbles; slightly calcareous; disseminated calcium carbonate; moderately alkaline (pH 8.4); gradual smooth boundary.

B22—11 to 15 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; few very fine and fine pores; 10 percent pebbles; moderately calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.6); gradual smooth boundary.

C1—15 to 24 inches; light gray (2.5Y 7/2) loam, light olive brown (2.5Y 5/4) moist; massive; loose, very friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine pores; 10 percent pebbles; strongly calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.8); clear smooth boundary.

C2—24 to 35 inches; light gray (2.5Y 7/2) loam, light olive brown (2.5Y 5/4) moist; massive; loose, very friable, slightly sticky; few fine roots; few very fine pores; 15 percent pebbles; strongly calcareous; disseminated calcium carbonate; strongly alkaline (pH 9.0); gradual smooth boundary.

C3r—35 inches; weathered shale.

Paralithic contact is at a depth of 20 to 40 inches. The particle-size control section is 0 to 15 percent rock fragments.

A1 horizon: Hue is 10YR or 2.5Y, value is 5 or 6 when dry, and chroma is 2 or 3. Texture is gravelly sandy loam, silt loam, and stony loam. Clay content is 15 to 22 percent.

B horizon: Hue is 10YR or 2.5Y, value is 5 to 7 when dry and 4 to 6 when moist, and chroma is 2 or 3. Texture is loam or clay loam. Clay content is 18 to 30 percent.

C horizon: Hue is 10YR or 2.5Y, value is 6 or 7 when dry and 5 or 6 when moist, and chroma is 2 or 3. Texture is loam or clay loam.

Guben Series

The Guben series consists of very deep, well drained, moderately permeable soils on canyonsides and mountain slopes. These soils formed in colluvium derived dominantly from sandstone and shale. Slope is 15 to 75 percent. Elevation is 5,000 to 9,500 feet. Average annual precipitation ranges from 14 to 20 inches, and average annual air temperature ranges from 38 to 45 degrees F.

These soils are loamy-skeletal, mixed Typic Calciborolls.

Typical pedon of Guben extremely bouldery loam in an area of Cabba family-Guben-Rock outcrop complex, in Prickly Pear Canyon, about 1,200 feet south and 2,000 feet east of the northwest corner of sec. 14, T. 12 S., R. 15 E.

O1—0.5 inch to 0; pine needles and grasses.

A1—0 to 7 inches; grayish brown (10YR 5/2) extremely bouldery loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; 15 percent pebbles, 10 percent cobbles, 5 percent stones, and 10 percent boulders; moderately calcareous; disseminated calcium carbonate; moderately alkaline (pH 8.2); clear wavy boundary.

B2—7 to 15 inches; pale brown (10YR 6/3) very stony loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; 10 percent pebbles, 15 percent cobbles, and 20 percent stones; moderately calcareous; disseminated calcium carbonate; moderately alkaline (pH 8.4); clear wavy boundary.

C1ca—15 to 30 inches; very pale brown (10YR 7/3) very stony loam, pale brown (10YR 6/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few fine, medium, and coarse roots; few very fine and fine pores; 10 percent pebbles, 20 percent cobbles, 20 percent stones, and 5 percent boulders; strongly calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.6); clear smooth boundary.

C2—30 to 60 inches; light yellowish brown (10YR 6/4) very stony loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; few very fine and medium pores and common fine pores; 10 percent pebbles, 20 percent cobbles, 25 percent stones, and 5 percent boulders; moderately calcareous; disseminated calcium carbonate; strongly alkaline (pH 9.0).

The mollic epipedon is 7 to 10 inches thick. The solum is 15 to 24 inches thick. The particle-size control section is 35 to 60 percent rock fragments. Secondary calcium carbonate is at a depth of 11 to 24 inches.

A horizon: Value is 4 or 5 when dry, and chroma is 2 or 3. Texture is extremely bouldery loam, extremely stony loam, or extremely bouldery fine sandy loam. Reaction is mildly alkaline or moderately alkaline. Calcium carbonate equivalent is 11 to 19 percent.

B horizon: Hue is 10YR or 7.5YR, value is 5 or 6 when dry and 3 or 4 when moist, and chroma is 2 to 4. Texture is very stony loam or very cobbly loam. Clay content is 17 to 22 percent. Rock fragment content is 35 to 55 percent. Reaction is mildly alkaline or moderately alkaline. Calcium carbonate equivalent is 20 to 25 percent.

Cca horizon: Hue is 7.5YR or 10YR, value is 6 or 7 when dry and 5 or 6 when moist, and chroma is 2 to 4. Texture is very stony loam or very cobbly fine sandy loam. Clay content is 17 to 25 percent. Rock fragment content is 35 to 60 percent. Reaction is moderately alkaline or strongly alkaline. Calcium carbonate equivalent is 20 to 38 percent.

C horizon: Texture is very stony loam or very cobbly fine sandy loam. Clay content is 17 to 24 percent. Reaction is moderately alkaline or strongly alkaline. Calcium carbonate equivalent is 19 to 30 percent.

Pathead Series

The Pathead series consists of moderately deep, well drained, moderately permeable soils on benches, ridges, canyonsides, and mountain slopes. These soils formed in colluvium and residuum derived dominantly from sandstone and shale. Slope is 15 to 70 percent. Elevation is 5,900 to 9,000 feet. Average annual precipitation is 14 to 20 inches, and average annual air temperature is 38 to 45 degrees F.

These soils are loamy-skeletal, mixed (calcareous), frigid Typic Ustorthents.

Typical pedon of a Pathead extremely stony loam in an area of Pathead-Curecanti family association, about 2 miles north and 4 miles west of Helper, about 1,100 feet north and 400 feet west of the southeast corner of sec. 6, T. 13 S., R. 9 E.

A1—0 to 3 inches; brown (10YR 5/3) extremely stony loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; few very fine pores; 5 percent pebbles, 15 percent cobbles, 40 percent stones, and 5 percent boulders; moderately calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.6); abrupt smooth boundary.

C1—3 to 14 inches; pale brown (10YR 6/3) very cobbly loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots and few fine and medium roots; many very fine pores; 20 percent pebbles and 5 percent cobbles; moderately calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.8); clear smooth boundary.

C2—14 to 26 inches; pale brown (10YR 6/3) very cobbly loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine and few fine roots; few very fine pores; 20 percent pebbles, 25 percent cobbles, and 5 percent stones; moderately calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.8); clear smooth boundary.

R—26 inches; sandstone.

Bedrock is at a depth of 20 to 40 inches. The particle-size control section is 35 to 60 percent rock fragments.

A horizon: Value is 5 or 6 when dry and 3 to 5 when moist, and chroma is 2 or 3. Texture is gravelly loam, cobbly loam, extremely stony fine sandy loam, extremely stony loam, or extremely bouldery fine sandy loam. Reaction is moderately alkaline or strongly alkaline.

C horizon: Hue is 10YR or 2.5Y, value is 6 or 7 when dry and 3 to 5 when moist, and chroma is 2 to 4. Texture is very cobbly loam, extremely cobbly loam, or very stony fine sandy loam. Clay content is 18 to 27 percent. Calcium carbonate equivalent is 11 to 28 percent. Reaction is moderately alkaline or strongly alkaline.

Podo Series

The Podo series consists of shallow, well drained, moderately rapidly permeable soils on benches, mesas, and mountain slopes. These soils formed in residuum and colluvium derived from sandstone, shale, and limestone. Slope is 1 to 70 percent. Elevation is 5,200 to 9,000 feet. Average annual precipitation is 14 to 20 inches, and average annual air temperature is 38 to 45 degrees F.

These soils are loamy, mixed (calcareous), frigid Lithic Ustorthents.

Typical pedon of Podo gravelly sandy loam, 1 to 8 percent slopes, about 26 miles northeast of Sunnyside, about 2,300 feet west and 50 feet south of the northeast corner of sec. 19, T. 12 S., R. 17 E.

A1—0 to 2 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak medium platy structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; few very fine roots; few very fine and fine vesicular pores; 20 percent pebbles; moderately calcareous; moderately alkaline (pH 8.2); abrupt wavy boundary.

C1—2 to 8 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; few very fine and fine pores; 10 percent pebbles; strongly calcareous; moderately alkaline (pH 8.2); clear wavy boundary.

C2—8 to 11 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; massive; soft, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; 25 percent pebbles; strongly calcareous; moderately alkaline (pH 8.2); abrupt smooth boundary.

R—11 inches; sandstone.

Bedrock is at a depth of 8 to 20 inches.

A1 horizon: Hue is 7.5YR or 10YR, value is 5 or 6 when dry and 3 to 5 when moist, and chroma is 2 to 4. Texture is gravelly sandy loam, gravelly loam, cobbly loam, very stony loam, or very bouldery sandy loam. Calcium carbonate equivalent is 12 to 15 percent.

C horizon: Hue is 7.5YR or 10YR, value is 5 or 6 when dry and 4 or 5 when moist, and chroma is 2 to 4. Texture is gravelly sandy loam, loam, or gravelly loam. Clay content is 13 to 27 percent. Rock fragment content is 5 to 35 percent. Calcium carbonate equivalent is 22 to 33 percent.